

Effect of CERDIK-Based Health Promotion on Healthy Lifestyle Behavior among Patients with Coronary Heart Disease: A Quasi-Experimental Study

Pengaruh Promosi Kesehatan Berbasis CERDIK terhadap Perubahan Perilaku Hidup Sehat Pasien Penyakit Jantung Koroner: Studi Kuasi-Eksperimental

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Abstract

Background: Coronary heart disease (CHD) remains a major cause of morbidity and mortality, and sustained lifestyle modification is essential for secondary prevention. The Indonesian Ministry of Health promotes CERDIK, a six-component healthy-lifestyle strategy comprising regular health checks, avoidance of cigarette smoke, regular physical activity, a healthy balanced diet, adequate rest, and stress management. Evidence regarding structured CERDIK education among patients with established CHD in hospital outpatient settings remains limited. Objective: This study evaluated the effect of CERDIK-based health promotion on knowledge, attitudes, and healthy lifestyle practices among patients with CHD. Methods: A quasi-experimental two-group pretest-posttest study was conducted in the cardiac outpatient clinic of Murni Teguh Hospital, Medan. Forty patients were recruited by purposive sampling and assigned non-randomly to an intervention group (n=20) and a control group (n=20). The intervention group received CERDIK-based health education for four weeks, whereas the control group received routine hospital education without CERDIK-specific material. Outcomes were measured before and after the intervention using questionnaires assessing knowledge, attitudes, and practices. Change scores were compared between groups using the Mann-Whitney U test. Results: After the intervention, 85% of participants in the intervention group had good knowledge, 85% had positive attitudes, and 45% had good practices; the corresponding proportions in the control group were 0%, 0%, and 10%, respectively. Mean change scores were substantially greater in the intervention group than in the control group for knowledge (25.75 vs 2.95), attitudes (27.30 vs 1.85), and practices (23.35 vs 1.85). Between-group differences were statistically significant for all outcomes (all $p < 0.001$). Conclusion: CERDIK-based health promotion was associated with significant short-term improvements in knowledge, attitudes, and healthy lifestyle practices among patients with CHD. These findings support consideration of CERDIK within outpatient secondary-prevention education, while larger randomized studies with standardized intervention delivery, objective clinical outcomes, and longer follow-up are needed to assess sustained effects.

Keywords: coronary heart disease; CERDIK; health promotion; behavior change; lifestyle; secondary prevention.

Abstrak

Latar belakang: Penyakit jantung koroner (PJK) tetap menjadi penyebab penting morbiditas dan mortalitas, sedangkan modifikasi gaya hidup yang berkelanjutan merupakan bagian utama pencegahan sekunder. Kementerian Kesehatan Republik Indonesia mempromosikan CERDIK sebagai strategi perilaku hidup sehat yang mencakup cek kesehatan secara berkala, hindarkan asap rokok, rajin aktivitas fisik, diet sehat dengan gizi seimbang, istirahat cukup, dan kelola stres. Bukti mengenai efektivitas edukasi CERDIK yang terstruktur pada pasien PJK di pelayanan rawat jalan rumah sakit masih terbatas. Tujuan: Penelitian ini menganalisis pengaruh promosi kesehatan berbasis CERDIK terhadap pengetahuan, sikap, dan tindakan perilaku hidup sehat pada pasien PJK. Metode: Penelitian kuasi-eksperimental dengan desain two-group pretest-posttest dilakukan di Poliklinik Jantung Rumah Sakit Murni Teguh Medan. Sebanyak 40 pasien direkrut dengan purposive sampling dan dialokasikan secara non-random ke kelompok intervensi (n=20) dan kelompok kontrol (n=20). Kelompok intervensi memperoleh edukasi kesehatan berbasis CERDIK selama empat minggu, sedangkan kelompok kontrol memperoleh edukasi rutin rumah sakit tanpa materi khusus CERDIK. Pengetahuan, sikap, dan tindakan diukur sebelum dan sesudah intervensi menggunakan kuesioner, kemudian skor perubahan antar kelompok dibandingkan dengan uji Mann-Whitney U. Hasil: Setelah intervensi, 85% responden kelompok intervensi memiliki pengetahuan baik, 85% memiliki sikap positif, dan 45% memiliki tindakan baik; pada kelompok kontrol proporsinya masing-masing 0%, 0%, dan 10%. Rerata perubahan skor pada kelompok intervensi lebih tinggi dibandingkan kelompok kontrol untuk pengetahuan (25,75 vs 2,95), sikap (27,30 vs 1,85), dan tindakan (23,35 vs 1,85). Seluruh perbedaan antar kelompok bermakna secara statistik (semua $p < 0,001$). Kesimpulan: Promosi kesehatan berbasis CERDIK berkaitan dengan peningkatan jangka pendek yang signifikan pada pengetahuan, sikap, dan tindakan perilaku hidup sehat pasien PJK. Temuan ini mendukung pertimbangan integrasi CERDIK dalam edukasi pencegahan sekunder rawat jalan, namun penelitian acak dengan protokol intervensi yang terstandar, ukuran hasil klinis objektif, dan tindak lanjut lebih panjang diperlukan untuk menilai keberlanjutan efek.

Kata Kunci: penyakit jantung koroner; CERDIK; promosi kesehatan; perubahan perilaku; gaya hidup; pencegahan sekunder.



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Introduction

Coronary heart disease (CHD) remains a major component of the global cardiovascular disease burden and is strongly influenced by modifiable risk factors such as tobacco exposure, unhealthy diet, physical inactivity, elevated blood pressure, dyslipidemia, diabetes, obesity, and psychosocial stress [1,2]. Contemporary chronic coronary disease guidance therefore places lifestyle optimization, physical activity, risk-factor control, and patient-centered education alongside pharmacological treatment as core elements of long-term management [3,4].

In Indonesia, cardiovascular disease is also a major public-health challenge. The problem is amplified by gaps in access, risk-factor control, treatment adherence, and continuity of secondary prevention. Indonesian evidence has highlighted the need to strengthen cardiovascular services and post-discharge risk management [5]. At the local level, records summarized in the source thesis showed a marked rise in cardiac outpatient and CHD-related service use at Murni Teguh Hospital over recent years, supporting the need for structured risk-reduction education in routine clinical care.

The Ministry of Health promotes the CERDIK strategy for prevention and control of non-communicable diseases. CERDIK comprises six behaviors: Cek kesehatan secara berkala (regular health checks), Enyahkan asap rokok (avoid cigarette smoke), Rajin aktivitas fisik (regular physical activity), Diet sehat dengan kalori seimbang (healthy balanced diet), Istirahat cukup (adequate rest), and Kelola stres (stress management) [6]. These components align closely with international cardiovascular prevention principles emphasizing smoking cessation, regular activity, healthy eating, sleep and stress management, and ongoing monitoring of cardiometabolic risk [3,4,7].

Behavioral change is not achieved by information exposure alone. Theoretical models such as the Health Belief Model, Theory of Planned Behavior, Social Cognitive Theory, and PRECEDE-PROCEED framework emphasize perceived risk, expected benefits, self-efficacy, social influence, and enabling conditions as mechanisms through which knowledge can translate into sustained action [8–11]. A 2024 umbrella review found that goal setting and planning, feedback and monitoring, shaping knowledge, and social support are among the behavior-change techniques most consistently associated with improved lifestyle behaviors across non-communicable diseases [12]. Recent Indonesian health-promotion studies also show that lifestyle, perceived risk, social support, and help-seeking behavior remain important determinants of chronic-disease prevention and treatment [13,14].

Previous Indonesian studies have reported that CERDIK-oriented education can improve knowledge and preventive behavior in hypertension and other non-communicable diseases [15–18]. However, evidence among patients with established CHD in hospital outpatient settings remains limited. This study therefore evaluated whether a structured four-week CERDIK-based health-promotion intervention could improve knowledge, attitudes, and healthy lifestyle practices among patients with CHD at Murni Teguh Hospital, Medan.

Methods

Study design and setting

This study used a quasi-experimental two-group pretest-posttest design and was conducted at the cardiac outpatient clinic of Murni Teguh Hospital, Medan, from November 2025 to January 2026. Both groups

completed baseline assessment, followed by a four-week study period in which the intervention group received CERDIK-based health promotion and the control group received routine hospital education; outcomes were then reassessed. Sampling was purposive and group assignment was non-random. The source thesis identifies separate intervention and control groups but does not document the exact allocation sequence, allocation concealment, or whether assignment followed order of attendance or different recruitment periods. Accordingly, this article does not infer a more specific allocation mechanism than is supported by the source records.

Participants and sampling

Participants were cardiac outpatients with coronary heart disease diagnosed by a specialist. The prespecified inclusion criteria in the source thesis were age 30-65 years, ability to read and write, willingness to complete all study procedures and provide written informed consent, and adequate physical and mental condition to participate. Exclusion criteria were age <30 or >65 years, cognitive or communication impairment, unwillingness to participate, and severe complications that prevented participation. Purposive sampling was used. The Federer approach yielded a minimum of 16 participants per group; the target was increased to 20 per group to allow for potential attrition, resulting in a total sample of 40 participants.

Intervention

The intervention group received CERDIK-based health promotion for four weeks. The educational content covered all six CERDIK domains: regular health checks; avoidance of active and passive tobacco smoke; regular physical activity appropriate to clinical status; a healthy balanced diet with attention to excess salt, sugar, and saturated fat; adequate rest; and stress management. The source thesis characterizes the intervention as structured and interactive, but it does not report the professional role of the educator, the number or duration of individual sessions, or the exact educational media and take-home materials used. These details therefore cannot be specified without additional author records. The control group received routine hospital education and did not receive CERDIK-specific promotional material; the source thesis likewise does not standardize or report the provider, content, or duration of the routine education. These reporting gaps limit reproducibility and the precision with which the incremental educational dose can be interpreted.

Outcome measurement

Healthy lifestyle behavior was operationalized through three domains: knowledge, attitude, and practice. Knowledge items used dichotomous scoring and were classified as good, sufficient, or poor. Attitude and practice items used Likert-type responses and were categorized according to the percentage thresholds stated in the thesis. The questionnaire covered the six CERDIK components. The source thesis reports that the knowledge/practice instrument adapted from Rizki had acceptable item validity and a Cronbach's alpha of approximately 0.75, while the attitude instrument adapted from Hakim also demonstrated acceptable validity and a Cronbach's alpha >0.70 [19].

Statistical analysis

Descriptive statistics were used to summarize participant characteristics and pre/post category distributions. Change scores (posttest minus pretest) were calculated for knowledge, attitude, and practice. Shapiro-Wilk tests were performed on the change-score data available in the thesis master dataset. Normality was not met consistently across comparison groups: knowledge change was non-normal in the intervention group ($p=0.011$), and all three change scores were non-normal in the control group (knowledge $p<0.001$; attitude $p=0.002$; practice $p=0.002$), whereas intervention-group attitude and practice changes did not significantly deviate from normality ($p=0.598$ and $p=0.090$, respectively). Given the inconsistent distributional assumptions and the small group size ($n=20$ per group), between-group differences in change scores were evaluated using the non-parametric Mann-Whitney U test. Statistical significance was set at $p<0.05$. Values reported by the statistical software as 0.000 are presented as $p<0.001$.

Results and Discussion

Research Results

Forty participants completed the study (20 intervention and 20 control). Men comprised 62.5% of the sample; 40.0% had completed senior high school; 45.0% were aged 50-60 years; 67.5% had lived with CHD for more than two years; and 35.0% reported a family history of CHD.

Table 1. Characteristics of study participants (n=40)

Characteristic	n	%
Sex: male	25	62.5
Sex: female	15	37.5
Education: no formal schooling	3	7.5
Education: primary school	4	10.0
Education: junior high school	11	27.5
Education: senior high school	16	40.0
Education: higher education	6	15.0
Family history of CHD: yes	14	35.0
Family history of CHD: no	26	65.0
Duration of CHD: <1 year	13	32.5
Duration of CHD: >2 years	27	67.5
Age: 35-50 years	11	27.5
Age: 50-60 years	18	45.0
Age: 60-70 years	11	27.5

Note: The source thesis specified an inclusion age range of 30-65 years, while its descriptive table reported an age category of 60-70 years. The category is reproduced as reported because exact ages were not available in the article dataset; the original case records should be checked before final submission.

Before the intervention, the two groups showed broadly similar distributions of knowledge, attitude, and practice categories, although the attitude and practice distributions were not identical. Following the four-week intervention, the intervention group demonstrated a clear shift toward favorable categories, whereas changes in the control group were modest.

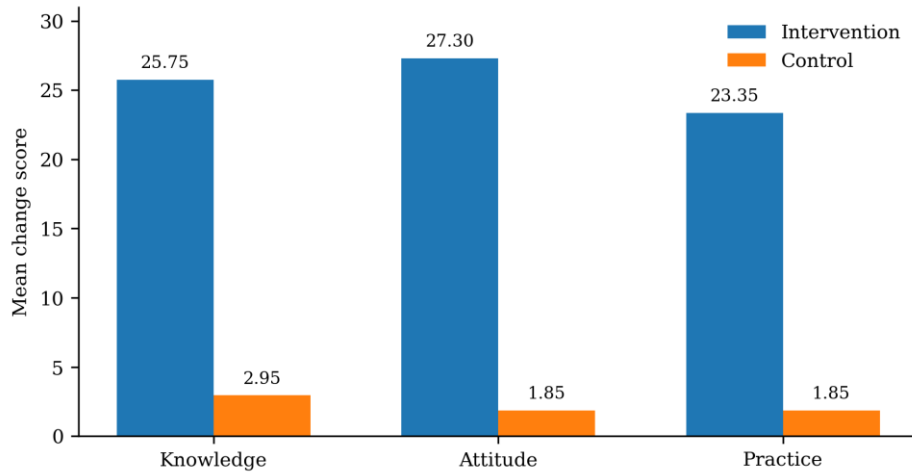
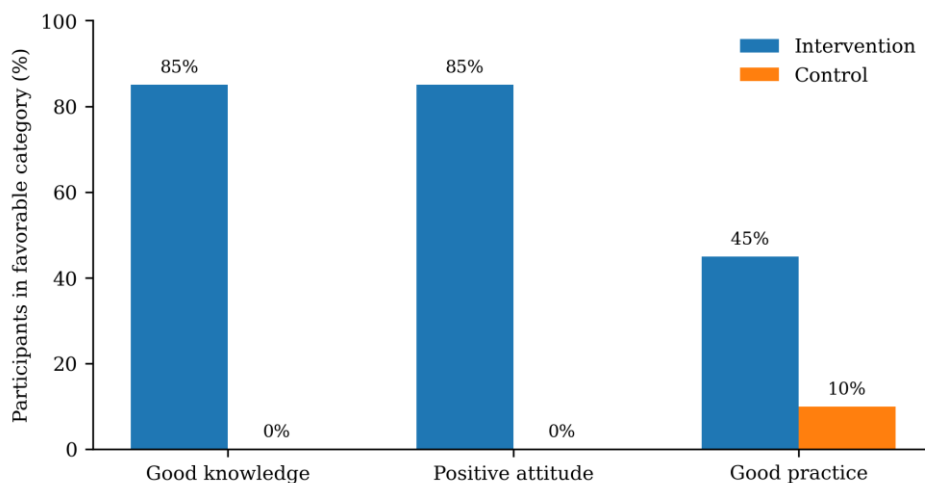
Table 2. Pretest and posttest distribution of knowledge, attitude, and practice categories

Domain	Group	Category	Pretest n (%)	Posttest n (%)
Knowledge	Intervention	Good	0 (0)	17 (85)
Knowledge	Intervention	Sufficient	8 (40)	3 (15)
Knowledge	Intervention	Poor	12 (60)	0 (0)
Knowledge	Control	Good	0 (0)	0 (0)
Knowledge	Control	Sufficient	8 (40)	19 (95)
Knowledge	Control	Poor	12 (60)	1 (5)
Attitude	Intervention	Positive	0 (0)	17 (85)
Attitude	Intervention	Neutral	5 (25)	3 (15)
Attitude	Intervention	Negative	15 (75)	0 (0)
Attitude	Control	Positive	0 (0)	0 (0)
Attitude	Control	Neutral	10 (50)	15 (75)
Attitude	Control	Negative	10 (50)	5 (25)
Practice	Intervention	Good	0 (0)	9 (45)
Practice	Intervention	Sufficient	6 (30)	11 (55)
Practice	Intervention	Poor	14 (70)	0 (0)
Practice	Control	Good	2 (10)	2 (10)
Practice	Control	Sufficient	7 (35)	10 (50)
Practice	Control	Poor	11 (55)	8 (40)

Between-group analysis of change scores showed statistically significant differences for all three outcomes. The intervention group had markedly greater mean changes in knowledge, attitude, and practice than the control group. The Mann-Whitney U statistic was 0.000 for each outcome, with $p < 0.001$.

Table 3. Between-group comparison of change scores

Outcome	Intervention mean $\pm$ SD	Control mean $\pm$ SD	Mean rank (I vs C)	p value
Knowledge	25.75 $\pm$ 4.494	2.95 $\pm$ 2.012	30.50 vs 10.50	<0.001
Attitude	27.30 $\pm$ 3.743	1.85 $\pm$ 0.875	30.50 vs 10.50	<0.001
Practice	23.35 $\pm$ 3.483	1.85 $\pm$ 0.933	30.50 vs 10.50	<0.001

**Figure 1.** Mean change (posttest-pretest) scores for knowledge, attitude, and practice in the intervention (n=20) and control (n=20) groups. Higher positive values indicate greater improvement; between-group differences were significant for all three outcomes (Mann-Whitney U test, all $p < 0.001$).**Figure 2.** Proportion of participants in favorable post-intervention categories in the intervention (n=20) and control (n=20) groups: good knowledge, positive attitude, and good practice. Values represent the percentage of participants within each study group.

Discussion

The principal finding of this study is that participation in the four-week CERDIK-based health-promotion program was associated with substantially greater short-term improvements in knowledge, attitudes, and healthy lifestyle practices than routine education alone. The intervention-control contrast was large across all three domains, with a mean-rank separation of 30.50 versus 10.50 and $p < 0.001$ for every outcome. Because group assignment was non-random, these findings should be interpreted as a strong between-group association within a quasi-experimental design rather than definitive proof of causality. Nevertheless, the pattern suggests that repeated, disease-relevant education may provide additional behavioral benefit beyond routine information in outpatient secondary prevention.

The improvement in knowledge is clinically relevant because patient education is a foundation for self-care and risk-factor control in chronic coronary disease. The 2024 ESC guideline notes that education can improve knowledge, self-care, empowerment, adherence to lifestyle interventions, and health-related quality of life, while also emphasizing that information alone is not always sufficient to produce behavior change [4]. Similarly, the 2023 AHA/ACC guideline recommends healthy dietary habits, regular physical activity, and cardiac rehabilitation as key non-pharmacological components of chronic coronary disease management [3]. The CERDIK module operationalizes these recommendations in a culturally familiar Indonesian framework.

Attitude changed markedly after the intervention: 85% of the intervention group moved into the positive-attitude category, compared with none in the control group. This pattern is consistent with health-behavior theory. In the Health Belief Model, perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy shape the likelihood of adopting preventive behavior [8]; in the Theory of Planned Behavior, attitudes contribute to behavioral intention [9]. The CERDIK components can be linked to these mechanisms in clinically meaningful ways: regular health checks provide cues to action, avoidance of tobacco and healthier diet emphasize perceived benefits and barriers, regular physical activity supports self-efficacy through achievable behavioral targets, and adequate rest and stress management broaden the intervention beyond biomedical risk control. These theoretical links explain why a multidomain education package may influence both cognition and attitudes, but they do not establish which individual CERDIK component contributed most.

The effect on practice is especially important because behavioral performance represents a more demanding endpoint than knowledge or attitude. After four weeks, 45% of the intervention group reached the good-practice category and none remained in the poor category, whereas 40% of the control group remained in the poor category. A 2024 umbrella review found strong and consistent evidence for behavior-change techniques involving goals and planning, feedback and monitoring, shaping knowledge, and social support [12]. The structured CERDIK intervention incorporates several of these mechanisms through repeated education, self-monitoring concepts, practical lifestyle targets, and encouragement from health professionals.

The findings are also consistent with Indonesian evidence. Azhari and Setiawan found that a CERDIK short-film intervention improved hypertension-control knowledge among older adults [15]. Hariawan and Pefbrianti summarized evidence that CERDIK programs can improve cognitive, attitudinal, and skill-related dimensions of non-communicable disease prevention [16]. Rahmawati et al. reported that CERDIK and PATUH education increased community knowledge and awareness related to CHD prevention [17]. More recent work continues to show that CERDIK behavior is influenced by knowledge, attitudes, access to information, and social support [18]. In parallel, SINTA-2 indexed Indonesian health-promotion studies published in 2025-2026 emphasize the continuing role of lifestyle patterns, perceived barriers, and health-seeking behavior in cardiovascular risk management [13,14].

The intervention's multidomain structure may explain why effects were observed beyond knowledge. CHD risk reduction requires simultaneous attention to smoking, physical activity, diet, cardiometabolic monitoring, sleep, and psychosocial health. Current international recommendations similarly favor comprehensive risk-factor management rather than isolated messages [3,4], and long-term observational evidence supports the cumulative importance of multiple healthy lifestyle factors for life expectancy [20]. Importantly, this study analyzed overall knowledge, attitude, and practice scores rather than domain-specific CERDIK outcomes, recall, or adherence. Therefore, the data cannot determine whether diet, stress management, smoking avoidance, or another CERDIK component was the dominant driver of change; attributing the effect to a specific component would be speculative. Future studies should score the six CERDIK domains separately and examine which components mediate sustained behavioral change.

Several limitations should be considered. First, the sample was small (n=40), recruited purposively from a single hospital, and assigned non-randomly; the exact allocation sequence was not documented, limiting causal inference and generalizability. Second, the source thesis did not report the educator's professional role, session frequency or duration, educational media, or the detailed content and duration of routine control education, which limits intervention reproducibility and makes the incremental educational dose difficult to quantify. Third, knowledge, attitude, and practice were measured by self-report questionnaires and may be affected by recall and social-desirability bias; no objective behavioral measures such as pedometers/accelerometers, activity logs, or food diaries/diet-tracking applications were used. Fourth, no clinical outcomes such as blood pressure, body mass index, blood glucose, or lipid profile were measured before and after the intervention. Fifth, the four-week follow-up captures only short-term behavioral change

and does not establish persistence, clinical risk-factor improvement, medication adherence, or reduction in cardiovascular events.

Future research should use larger multicenter samples, randomized allocation where feasible, a fully standardized intervention protocol with documented educator training, session duration and frequency, specified educational media, and a clearly described comparator. Follow-up at approximately 3 and 6 months is recommended to assess retention of CERDIK behaviors. Objective behavioral measures (for example, pedometer/accelerometer data and food records or diet-tracking applications) should be combined with clinical endpoints such as blood pressure, body mass index, lipid profile, glycemic measures, smoking status, medication adherence, and quality of life to determine whether behavioral improvements translate into measurable cardiovascular risk reduction.

At Murni Teguh Hospital, the findings support development of a standardized CERDIK education pathway within the cardiac outpatient workflow. A practical implementation model would include a written CERDIK module or checklist, training for outpatient nurses and health-promotion staff, documentation of the topics covered and educational dose at each visit, patient take-home material, individualized goals, family involvement, and scheduled reinforcement. This approach would make routine education more consistent and auditable while allowing the hospital to monitor fidelity and outcomes. Because the original study did not document the exact content of routine education or intervention dose, these elements should be standardized prospectively before CERDIK is adopted as a formal service policy.

Conclusions

A four-week CERDIK-based health-promotion intervention was associated with significantly greater short-term improvements in knowledge, attitudes, and healthy lifestyle practices among patients with CHD than routine hospital education. The findings support CERDIK as a practical, culturally relevant framework for outpatient secondary-prevention education, but they should not be interpreted as definitive evidence of long-term clinical effectiveness because allocation was non-random, intervention delivery was incompletely documented, outcomes were self-reported, and clinical endpoints were not measured. For nursing practice and hospital policy, Murni Teguh Hospital should consider a standardized CERDIK module, training of cardiac-outpatient nurses and health-promotion staff, and documentation of educational content and dose as part of the CHD outpatient service pathway. Follow-up studies at 3-6 months using objective behavioral measures and clinical parameters such as blood pressure, body mass index, and lipid profile are needed to confirm sustainability and clinical impact.

Conflict of Interest

The authors declare no conflict of interest related to this study.

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